

# **Natural Gas Storage in Basalt Aquifers of the Columbia Basin**

## **Water Resource Considerations**

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April 8, 2003

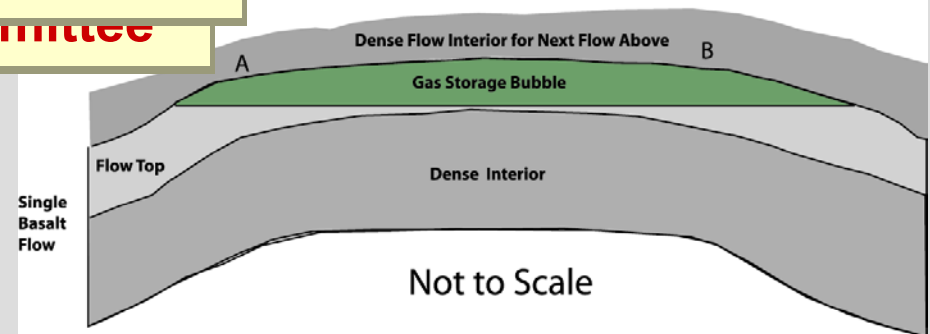
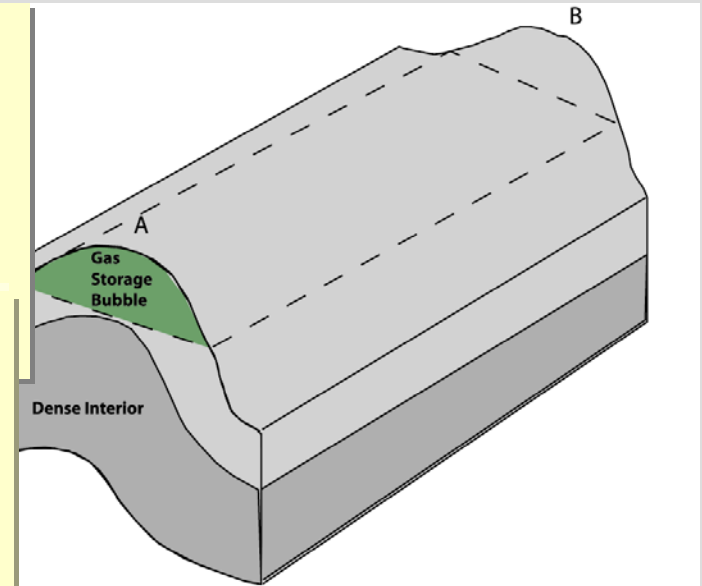
# Regulatory and Legal Basis

## Federal

1. Federal Energy Regulatory Commission
2. Natural Gas Act

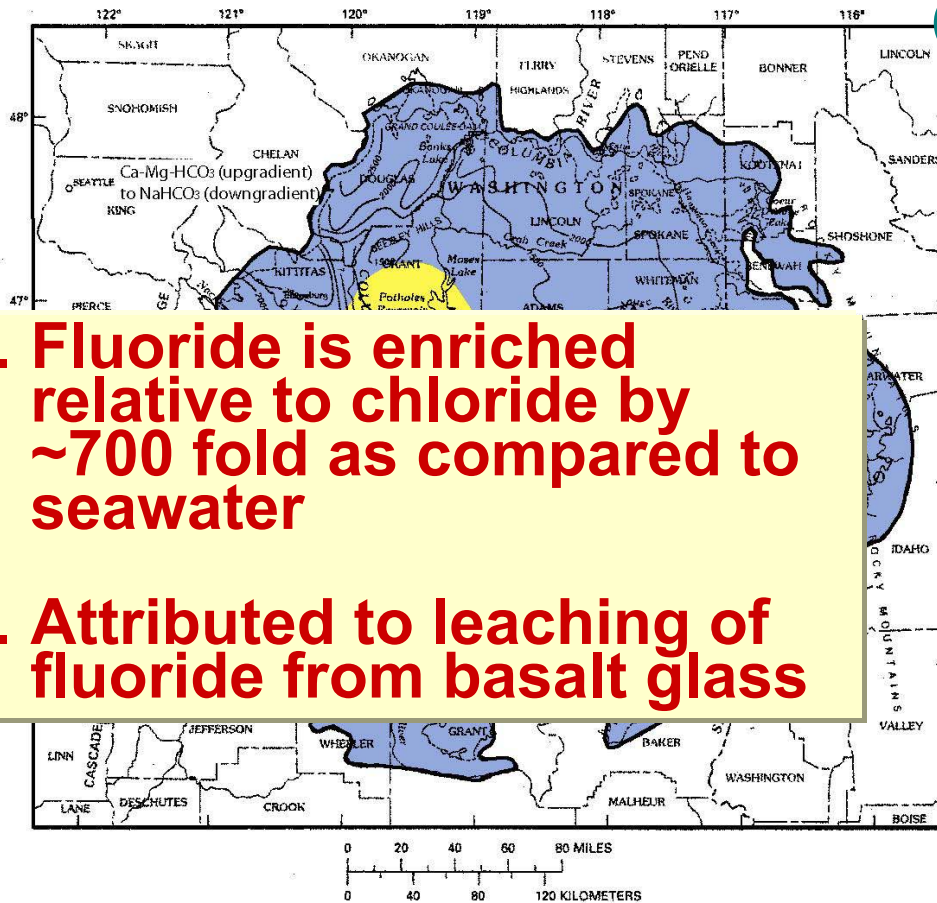
## Eminent Domain Determination

1. Not a source of fresh water
2. Will not contaminate any useable freshwater resource
4. Oil and Gas Conservation Committee



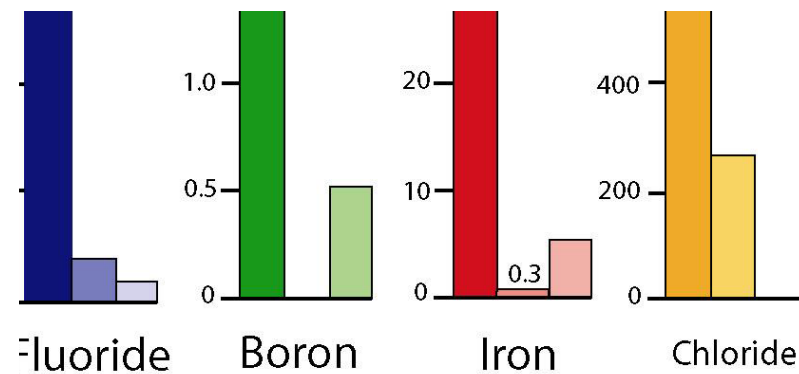
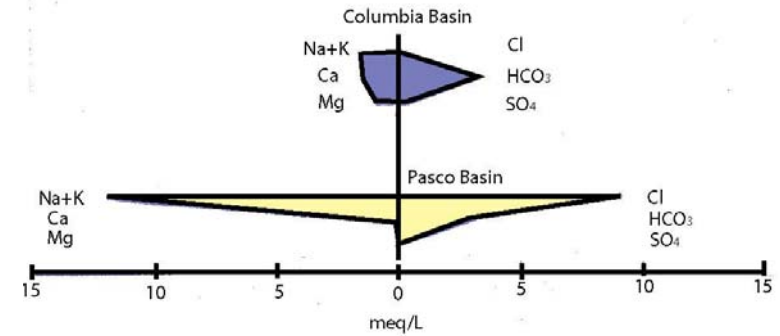
# Deep Basalt Aquifer Water Quality


## Grande Ronde Basalt



**1. Fluoride is enriched relative to chloride by ~700 fold as compared to seawater**

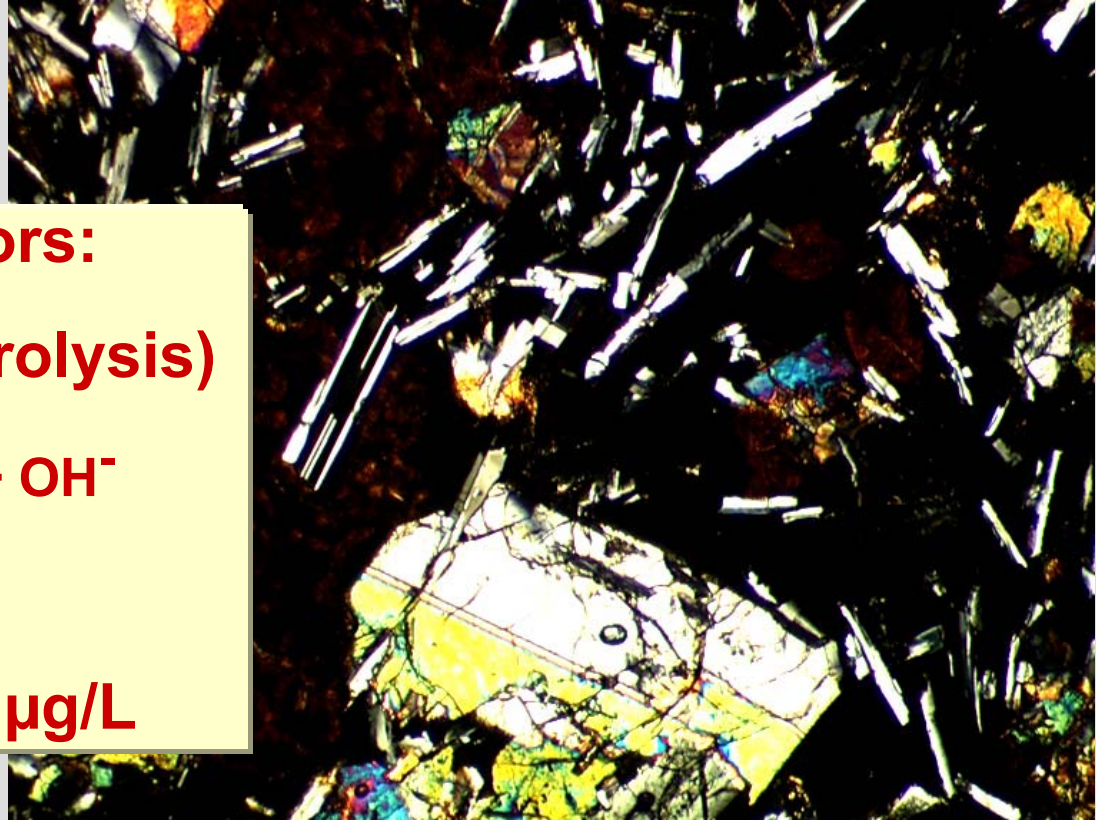
**2. Attributed to leaching of fluoride from basalt glass**



Maximum Observed →  ← Irrigation Water Criteria  
Drinking Water or Secondary Standard

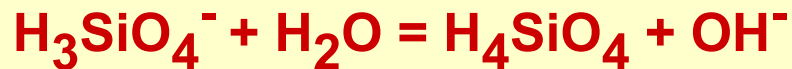
Pacific Northwest National Laboratory  
Department of Energy

# Grande Ronde Flow Top Polarized Light Photomicrograph (thin section field of view ~6X6 mm)



## Other Water Quality Factors:

1. pH: 9 – 10 (silicate hydrolysis)



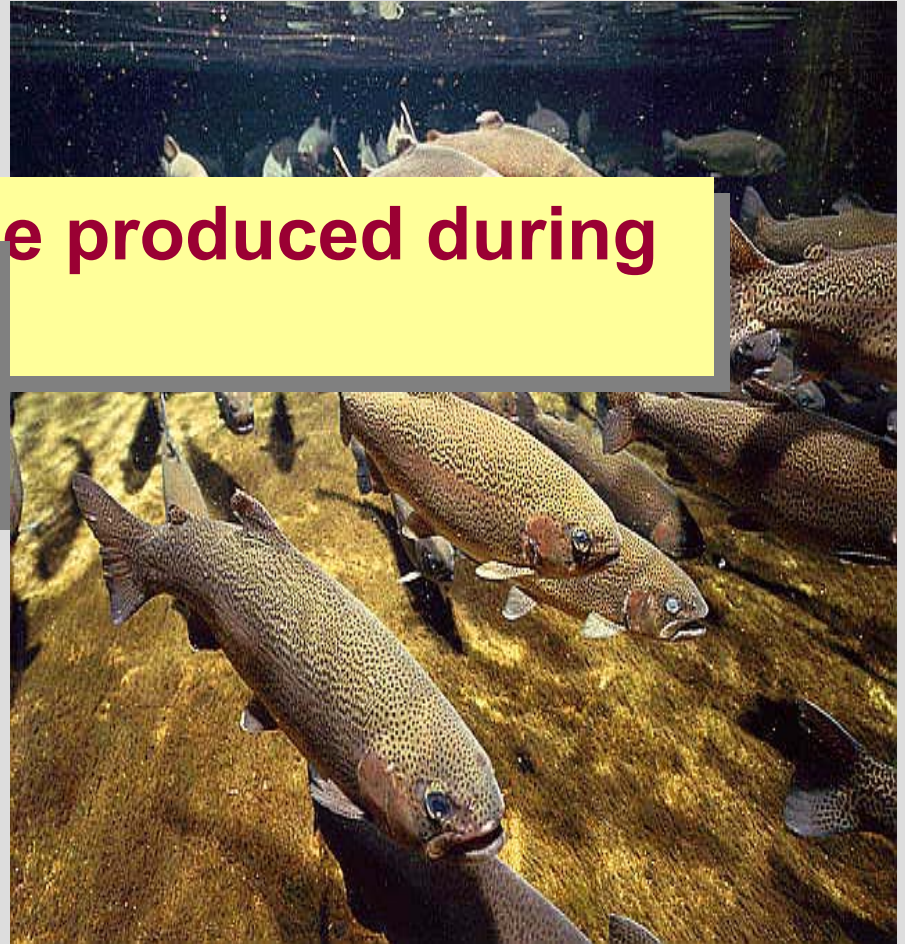
2. Temperature ~ 40°C

3. Dissolved oxygen < 20 µg/L



# Produced Water Volume and Protection of Freshwater Resources

1-100 gal / acre ft be produced during  
Need aeration and  
dilution to protect  
aquatic life



# Produced Water Volume and Protection of Freshwater Resources

**Need to blend with  
irrigation water**

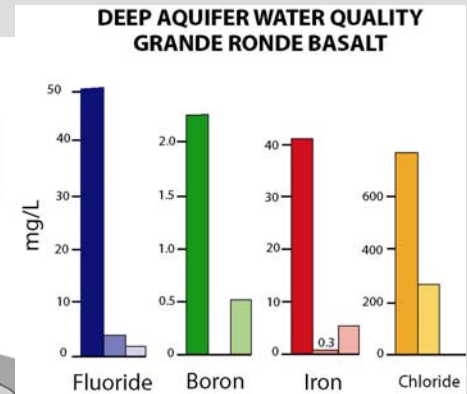
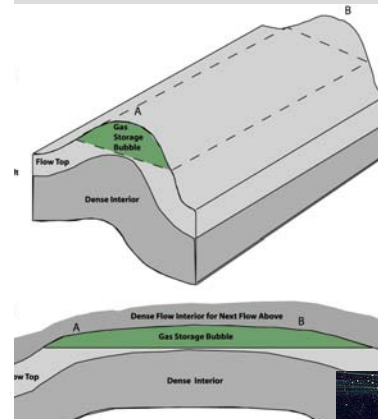
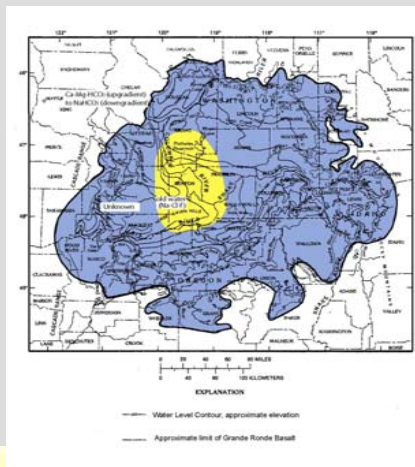
**1. Prevent crop stress**

**2. Meet return flow  
criteria**





# Summary and Conclusions



**Possible Solutions:**

1. Pretreatment
2. Mixing/aeration
3. Blending with irrigation water

be a problem

